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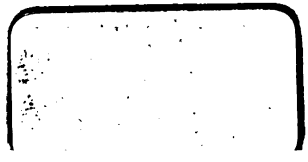
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A
TEMPERANCE
READING BOOK



A

TEMPERANCE READING BOOK;

OR;

ELEMENTARY CHAPTERS ON ALCOHOL AND INTOXICATING DRINKS.

FOR THE USE OF JUVENILES.

BY

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PREFACE.

THE wide-spread and increasing interest now manifested in the Temperance Movement is a sufficient reason or demand for a liberal supply of reliable and scientific information on the subject, that every one who embraces it may be able to give a satisfactory reason for the opinion he holds, and for the course of conduct he pursues.

The object of this little work is to set forth such information for a special class of pupils—viz., our boys and girls.

Whilst endeavouring to lay it before them in a scientific manner, I have avoided technical terms as much as possible.

I have striven to adhere to simple and homely phraseology, but have adopted a

somewhat argumentative style, in the hope that by thus appealing to the thinking capacity of the reader, the truths may produce a lasting impression.

The only apology I offer for the reiteration of some of the principles contained in the book, is their importance.

This volume owes its origin to the frequent reference to 'Temperance in Elementary Schools,' which appeared in the *Temperance Record* during 1878.

The manuscript was completed early in 1879; but the idea contained in it was anticipated, and Dr. Ridge's 'Temperance Primer' seemed to cover the ground.

However, after the lapse of a year, I send it forth as one drawing a bow at a venture, with hesitancy, yet with hope that it may meet with favour and add something to the progress of true temperance.

J. I.

UPPER TOOTING, SURREY,
January, 1880.

A TEMPERANCE READING BOOK.

Introduction.

1. If I were to ask you to write down on a piece of paper the names of every different thing you have ever seen or heard of, in less than a week I have no doubt some of you would be able to make a very long list, containing hundreds of names. Thus there would be a great many kinds of trees, vegetables and animals; also minerals, such as gold and silver. Then there would be the various sorts of clothing and the different kinds of food, workmen's tools, and all the things that are manufactured by man — children's toys, books, etc., and so on, almost without end.

2. Now I want you to understand, that

though there are so many different things in the world, yet, as far as man has been able to discover, all these are very wonderfully made out of only a few things. Indeed, all the world and everything that is in it, and probably the sun, moon and stars also, are made out of not more than sixty-five or sixty-six simple things, which are called elements.

3. By an element is meant a substance that has resisted every known method of trying to break it up into a simpler form of matter. Gold is a simple body, and, however it is chopped up or experimented upon, no one has ever been able to find anything but gold in it, neither have they ever been able to turn it into silver or copper, or anything else. It is therefore termed an element.

The things that contain or are made up of more than one element, are called compound bodies. Thus, you see, we may divide everything in the world into two classes, viz., first, simple bodies, or elements; second, compound bodies.

4. Chemistry is the science which teaches us to examine the properties of these elements, and of the different compound bodies they form by uniting together in different ways, and to understand the laws which regulate their combinations with each other.

5. You have been taught to believe that everything in the world has been made by God; but when you look around you, you see a great many things that you *know* have been made by man, as houses, and pictures, and furniture, and this may seem to you like a contradiction. But I think the difficulty will soon fly away if I get you to believe that God made *all the elements;* and, having done that, He made a law concerning them, and then sent them forth into the universe, saying, 'Go and fulfil the law I have made.' It is by the fulfilment of this law that every compound body in the universe is made. Because this law works so perfectly, some people try to teach that all things make themselves, and

that everything *must be* exactly what it is. They forget that God made the elements, and that He also made the law by which the compounds are made out of the elements; that therefore He may very justly be said to be the Creator of everything.

6. This law is often called the *Law of Nature;* and in this case Nature is only another name for God. The law may be expressed by saying that whenever the elements are brought together in certain ways, and under certain conditions, a very wonderful change takes place, and something quite different from either of the elements is formed. Not that the elements themselves are really turned into something else, for they are still the same; but the new body formed by their uniting together is very different from either of them by themselves. This change is called a *chemical change.* It is guided by a law which, under the same conditions, always produces the same result.

7. Suppose the potatoes your mother put into the pot to boil for dinner were, during the cooking, gradually turned into turnips or apples, would you not be very much surprised, and almost inclined to disbelieve your own eyes? Or again, suppose you saw her take some flour, currants, sugar, suet, eggs, etc., make a plum-pudding, tie it up in a cloth, and put it in the saucepan to cook. Suppose you sat by the kitchen-fire, and kept your eye on it all the time it was cooking, and were quite certain that no one had touched it. Would you not stare very hard if, when your mother turned it out for dinner, it were changed into a rabbit-pie or beef-steak pudding? You might indeed begin to think that the days of fairies and magicians had returned.

Such a thing as I have supposed is never likely to occur, but what I want you to understand and believe is, that, if it did, it would be nothing more wonderful or remarkable than things that are taking place every day.

You go into a field, and see a cow eating grass, or hay and turnips, and drinking water. Now, by the wonderful law God has made, that food is turned into milk and flesh; but you know very well that milk is not a mere mixture of turnips or grass and water.

Again, if you eat bread and cheese, I may tell you that a part of it is turned into flesh and bone; but I am sure you would never think of calling your bodies bread and cheese. In each of these cases a chemical change has taken place; *yet,* strange to say, though the milk is such a very different thing from a mixture of turnips and hay and water, the chemist is able to find the same *elements* in each of them; and though bread and cheese differs greatly from flesh and bone, the chemist can find the same *elements* in both of these also.

8. Changes of this kind are going on all over the world in a great many ways; thus some of the things both in the air and in the

ground are being turned into plants and trees and flowers. The trees and plants that flourished a great many years ago have been changed into the coal that is now found in the mines. This coal, in its turn, will be burnt, but even the burning cannot destroy the *elements*, that is, turn them into *nothing*. It only turns them into gases, which may possibly some day help to make trees again. Our bodies, when they are put into the grave, will gradually change into something else, and that something else will combine with other elements and form new compounds. All these sort of changes are chemical changes, which have been going on ever since the world began, and they will go on repeating themselves over and over again for ever.

9. I want you to believe, even if you cannot understand, that not one of the elements can ever be destroyed or lost, and that no *element* s ever transformed into another element; but that thousands upon thousands of compound

bodies are formed by the sixty-six elements uniting in different ways together.

I have told you that all these wonderful changes take place in accordance with a certain law, which I called the Law of Nature.

10. Now the man who makes it his business to study the science of Chemistry and to understand the laws which regulate these many changes which are going on in the world, is called a chemist.

We may call Nature a great chemist, and man his pupil. He is a very clever pupil, and in prosecuting his studies he makes a great many experiments; he is often very successful, and can artificially make many of the compounds which are being so wonderfully yet easily made in nature. It is true he has never been able to make trees or flowers; nor with all his skill and patience has he ever been able to make a simple element. Nevertheless, it is because he is able to imitate his Master so well that England has become such a great

and rich manufacturing nation; for there is hardly a manufacture of this great country that does not owe its success, in a great degree, to the science of Chemistry.

The manufacture of intoxicating drinks is, from beginning to end, a chemical process, and depends for its success upon the chemical changes which the substances out of which the drinks are made undergo. This is the reason why I have thought it wise to write so long an introduction to what is to follow.

11. Before we begin a new chapter, however, I want once more to impress upon you the great importance of a chemical change —and it is this, viz., that after this change has taken place, it does not matter in the least what things we had to start with; what we have to do is to examine the new compound formed, to examine *it*, and see what its properties are and what use can be made of it.

I am particularly anxious that you should

understand this, and always bear it in mind, because you will often hear people say that because barley is good for food, therefore beer, which is made out of barley, must also be good. They will say because grapes are nutritious, therefore wine, which is made out of grapes, must be nourishing. They will even go so far as to say that because God sent barley and grapes, therefore He sent wine and beer.

12. You will be able to tell them that in these two cases a chemical change has taken place, and that very often a poison is made out of two things which by themselves, before the chemical change occurred, were quite harmless; and that also, sometimes two very deadly poisons might be made to undergo a chemical change by being mixed together, and that they would produce a new compound which would not injure you at all, even though you eat a great deal of it. So that you see, the beer *might* be good for food, and the wine

might be nourishing, but that they are not so necessarily.

You could further tell them that chemists have examined their properties, and that the wisest and cleverest men say that they are injurious when taken into the body, because they both contain a small quantity of a deadly poison, which was not in either the barley or the grapes.

CHAPTER I.

Water.

13. WATER! what a simple and homely name! Yes, from your earliest childhood it has sounded in your ears, and the thing itself has become so familiar to you, that probably you do not know, and have never thought, what a barren wilderness our world would be without it.

14. Perhaps the only things that are actually necessary to us are Food, Water, and Air: many other things, of course, are a great advantage and comfort to us; but if either of these three things was taken away from us we should immediately die. Water is quite as valuable as food or air; it may therefore undoubtedly be classed as one of God's best gifts to man.

15. If you turn to your geography you will find that nearly three-quarters of the surface of the whole earth is covered with water. I may tell you, moreover, that all living trees, plants, and fruits contain a great deal of water; and that, strange as it may seem to you, even your own bodies contain about eighty per cent. of water. That is to say, if your body weighed 100 lbs., as many as 80 lbs. would be nothing but water. Even the very hardest part of your body—the very bones —contain some water.

This amount of water is also found in the flesh of sheep and cattle; so that when your mother pays one shilling for a pound of butcher's meat she really pays ninepence for three-quarters of a pound of water: this is one of the facts that makes butcher's meat such a very expensive food.

Again, the very best new milk that you can get contains about eighty per cent. of water.

16. Pure water in small quantities is quite

clear, and is said to be colourless; but when it is seen in very large quantities, as in the lakes in Switzerland and other places, it has a deep blue or ultramarine appearance, resembling a magnificent and cloudless sky on a quiet summer's day.

17. Water possesses in a very wonderful degree the power of dissolving solid substances; indeed, there is no other fluid in the world that will dissolve so many things as water, and it is on account of this property that water is seldom found *perfectly pure*. As it bubbles up through the ground, forming springs; as it trickles down the hills as gentle streams; or as it rushes through the valleys and across the plains on towards the ocean, as mighty rivers, in each case it takes up and dissolves a portion of some of the materials it comes in contact with in its course.

The things, however, with which water is generally contaminated do not make it undergo any *chemical change:* it remains merely a

mixture of pure water, with the other things added to it.

18. We are familiar with water in three different conditions, viz., a solid, as ice; a fluid, as we commonly know it; and lastly a vapour or gas, as steam. The uses of water are so many and so important, that I might write a whole book upon the subject.

19. The dew, which in tiny drops is so delicately and silently laid upon every leaf and blade of grass during the quiet hours of night; the gentle shower and the drenching torrent; the little rivulet and the greater stream; the smallest pond as well as the broad lake and mighty ocean—are all full of lessons we might learn about the value of water: it would, however, be beyond my purpose to enter into its uses, except so far as it fulfils the requirements of a drink.

20. In this respect we shall find that it is perfection itself. As I have already told you that about eighty out of every hundred parts

of your bodies are water, you may very naturally form the idea that water is a food. In the true sense of the word this is *not* the case; therefore, at the outset, I want you to understand that there is a very important difference between a food and a drink. The water we drink, whether we drink it as water simply, or as water mixed with other things, as tea, coffee, cider, ale, wine, or any of the other common beverages, does not undergo any change, and thus help to form our bones and muscles; it merely increases our size, but remains in our bodies just the same as before we drank it, simple water.

21. The solid parts of our bodies can only be made up out of solid matters which we eat in the solid state, such as bread and cheese; or solid matter which is dissolved in some fluid, as beef-tea and milk. Now pure water contains no solid matter, and as it does not undergo a chemical change in the body, we should soon find out that it was not a food if we tried to live on it alone.

22. The chief, if not the only, object of a drink is to dissolve the useful parts of the food we eat, and to render it into such a state that it may be changed into the blood, out of which all the other parts of our bodies are made.

The great solvent power of water, together with some other properties which it possesses, render it the fluid, far above every other known fluid, most suitable for drinking.

23. Not only man, but every living thing, both animal and vegetable, requires drink. Throughout the entire world, however, it is found that the natural drink which God has so abundantly provided, water, is quite sufficient to quench the thirst of the dry and withering grass, the parched corn and fading leaf; further, there is no animal that will not thrive and feel satisfied with water for its drink, until it has been taught an artificial taste for other fluids.

(There are some cases where milk is preferred, and is more suitable, but this is where the animal requires food as well as drink. And

you must not forget that milk is only water, mixed with food that nature has manufactured; so that *it* is both a food and drink at the same time.)

24. Think of a few of the animals most useful to man—the horse, the cow, the camel and dog—and you will find that water is the only drink they care for, and that it is quite sufficient for them. Again, if you turn to some of the strongest wild animals, as the elephant, lion, tiger and bear, you will learn that even these find water the only drink they need.

25. Man, also, in the early ages of the world, was quite content with water. After a while he made experiments with other things, as the juices of fruits and plants, infusions of herbs and roots. Some of them he found very pleasant to the taste, and others disagreeable. Man is still constantly making experiments to gratify his palate, and as one of the results of these, we have an immense number of beverages or drinks in common use.

26. There is not one of them that does not contain water. Some of them are nearly all water, others less; but even what are called strong drinks, as brandy, rum, and whisky, contain about half water.

The more water they contain, and the less of anything else, the better it is for him who drinks them; but if this be the case, I think you will agree with me that if they contained nothing but water they would be best of all. Indeed, many experiments have proved that pure spring water is a wholesome drink and the most grateful one to those who are thirsty, whether sick or well. It has also been proved that the most vigorous health may be maintained and the hardest work performed under all conditions of life without any other beverage and that no other drink is actually required.

27. From what I have told you, I trust you have formed some idea of the importance of water, and of the liberal manner in which nature has distributed it all over the world.

28. I wonder if the thought has ever struck you to inquire whether this familiar and useful substance is one of the sixty-six elements out of which everything else is made, or whether it is a compound body, and if a compound body, how it is made, and what elements it is made out of. I hope you are curious to know all this.

29. There was a time when water was thought to be one of the elements, but since then the world has grown wiser. Our chemists have found out that water is a compound body, that it is made out of two elements by bringing them together and making them undergo a chemical change. The two things are found to be gases, and are called Oxygen and Hydrogen.

We can separate water into these two things, and we can form water by bringing the two elements together in the proper quantities.

30. The change which takes place is so wonderful, that we may well talk about the

marvels and the magic of chemistry. The manufacture of water beautifully illustrates what I told you was meant by a chemical change. The following example, I hope, will make it so plain to you, that you will be willing to believe in many strange and remarkable occurrences in connection with chemistry.

31. If you could get an immense barrel, and put into it about 1,100 quarts of hydrogen gas and 550 quarts of oxygen, and then by means of an electric current make the mixture undergo a chemical change, the gases would unite together in a wonderful way and make rather less than one pint of water. It may seem almost impossible to you that these 1,650 quarts of gases are entirely used up in making so small a quantity of water as one pint. It is nevertheless quite true; and what is more, the water has not the slightest resemblance to either of the gases out of which it was made. This I shall show you more plainly in the next chapter.

CHAPTER II.

Hydrogen. Symbol H. Combining weight 1.

32. You have already learnt that hydrogen is one of the elements, and that it enters into the composition of water. When in a pure and free state, that is, has nothing mixed with it, it is a gas, it cannot be seen, is without smell, and has no taste. It is the lightest substance known in the world, and for this reason it is used as the standard with which all the other elements are compared, when we want to give you an idea of their weight; that is, to make you understand how much heavier one body is than another.

I told you that it required about 1,100 quarts of hydrogen to make less than one pint of water. Now, when I tell you that

these 1,100 quarts of gas only weigh 2 ozs., I think you will at once believe that it must be a very light substance indeed. It is about fourteen and a half times lighter than the air we breathe, and which presses all around us so softly that we hardly imagine it has any weight at all. It is exactly sixteen times lighter than oxygen, the other constituent of water.

It is represented by the letter H, to save the trouble of writing the word in full; and because, as I have already told you, it is the lightest substance known, its combining weight is 1.

33. This gas may be obtained from a great many compounds which contain it, but it is almost always obtained by decomposing water, of which it forms one-ninth by weight.

34. Hydrogen will burn in contact with air. The flame has a pale yellowish-blue colour, giving very little light, but an immense amount of heat. Although it burns itself, it

will not help other things to burn; and, although it is not a poison, it cannot support the life of an animal.

If a burning taper or match be pushed up into a jar of this gas, the hydrogen will be kindled at the mouth of the jar, but the light will be extinguished. It will, however, be relit by the flame at the mouth as the taper is drawn out of the jar. The jar must be kept upside downwards, for if the jar were held with the mouth upwards, the gas would immediately rush out, because it is so much lighter than the air, which would fall into the jar and take the place of the hydrogen.

35. The hydrogen, as it burns, combines with some of the oxygen that is in the air, and forms water again. This may be easily shown you by holding a clean dry tumbler over the flame, as the gas issues through and burns at the end of a small glass tube.

The glass is immediately covered with moisture; and, if a few drops of this moisture

be collected and examined, it will be found to be pure water. This is another example which helps to prove to you that even burning a body won't actually destroy it. Hydrogen is very fond of oxygen; I might say, there is such a mutual love or attraction between the two, that, whenever they can get the chance, they rush together, and then chemically combine, forming water.

36. Whenever you see a flame, such as the burning of a lamp or a candle, a wood or coal or gas fire, you may be quite sure that water is being manufactured.

You may see an example of this very plainly in the winter-time, when the shopkeepers burn a lot of gas and keep their doors shut. The steam, or water, streams down their windows, sometimes spoiling their goods, and on the cold nights freezing upon the panes of glass, often becoming quite a nuisance to them.

37. Hydrogen was at one time employed for

filling balloons, but owing to its extreme lightness, it has such a great tendency to escape from any vessel in which it is put, that it has been replaced by coal-gas; but the balloons have to be made very much larger.

CHAPTER III.

Oxygen. Symbol O. Combining weight 16.

38. This is the name that is given to the other element which, combined with hydrogen, forms water.

Like hydrogen, it is a colourless, odourless, and tasteless gas. However, its properties are unlike it, for it will not burn itself, but it is a great supporter of combustion and of animal life; indeed, without it nothing will burn and no animal will live.

39. It is represented by the symbol or letter O, and its combining weight is 16, because it is sixteen times heavier than hydrogen. It is a trifle heavier than common air.

It was discovered rather more than a hundred years ago, almost at the same time, by two

men—one an Englishman and the other a Swede. The name is derived from two Greek words, which signify to make sharp or acid, because it is found that nearly all substances produced by burning in oxygen possess a sharp or sour taste, like vinegar.

40. It is the most abundant and widely diffused of all the elements; for it forms nearly one-half by weight of all the rocks and stones out of which the solid part of the earth is made, eight-ninths of all the water, and about one-fifth of the atmosphere. It may be spoken of as a great favourite, as it enters into combination with every known element except one, fluorine, forming a class of bodies called oxides. Nor is it only with the other elements that oxygen is a favourite; but to the young student of chemistry, also, it is one of the most pleasing and interesting of the gases, as a great many pretty experiments may be performed with it.

41. I told you it would not burn itself,

but that it was a great supporter of combustion; that is, it will make other things burn much more quickly and brilliantly. If you have a jar full of it and introduce into it a lighted taper, the taper will burn with a dazzling light; if you blow out the flame and introduce the smouldering wick it will immediately re-light itself; and if a small piece of burning phosphorus be introduced into the gas, the light becomes so brilliant that you can hardly look at it.

Even fine iron-wire can readily be made to burn in this gas; and if a piece of lighted charcoal be suspended in it, it will throw off a brilliant shower of sparks, like fireworks.

42. Although oxygen exists in such an abundant state both in water and in the air, it is not generally obtained from either of these sources, but by decomposing some of its other numerous compounds.

A very easy and common, and for experimental purposes perhaps the best, method is

to take red oxide of mercury (the substance you get at the druggist's shop when your mother sends you for 'red precipitate'), place it in a glass flask or tube, and apply to the latter the heat of a spirit-lamp; by means of the heat oxide of mercury is soon split up into the two things it consists of, viz., oxygen gas and metallic mercury. The gas may be collected in jars over water and examined.

There are many other modes of procuring the gas when large quantities are required, and it is important to do it cheaply.

43. Though oxygen cannot really be called a food, yet we could not live without it.

When we draw the air into our lungs in the process of breathing, we of course take in a large quantity of oxygen. The blood which is made out of our food contains substances which slowly burn by the aid of the oxygen thus taken into the system. It is by this burning up of a portion of our food that the body is kept much warmer than the things

that surround it. If there is no food to be burnt up, the fire goes out, the blood becomes cold, and the body dies; that is, i starved to death. The same result follows if the supply of oxygen is cut off; this sometimes happens, and people are then said to be suffocated.

44. The heat produced by the burning of the food in the body is equally distributed by the circulation of the blood all over the system, so that no part seems to be on fire, but the whole is kept pleasantly warm, just in the same way as the hot-water-pipes in your schoolroom or church carry the heat all over the building and make it comfortably warm in every part.

Now, if your food were all burnt at one spot—say at the end of your nose or the tips of your fingers—there would be quite a flame, and you would be no more able to endure it than you could bear putting your hand into the fire, in the stoke-hole, that heats the

boiler that supplies the pipes with hot water.

If the air were made of nothing else than pure oxygen, our food would burn so rapidly that there is little doubt that we should burst into a flame and perhaps go off like gunpowder.

45. Some of you may wonder what all this has to do with temperance, and think I have been wandering far away from my subject; no, my desire is that you should have a sound reason for the course you pursue, should you wish to become a total abstainer, that you may be able to give an answer to those who differ from you. You will find by-and-by, that the information I have imparted to you fits in very capitally to fulfil that object.

46. I want you, now, to compare very briefly the three things I have written about, viz.:

Water.	Hydrogen.	Oxygen.
Water is invaluable as a drink, and quenches thirst better than anything else. It is not actually a food, but it is the only thing in the world that is capable of dissolving our food and bringing it into a state from which our flesh and bones can be formed. It will not burn, neither will it help other things to burn; but it is one of the best things with which to put out a fire.	Hydrogen is quite useless as a drink. If you could drink pure hydrogen gas for a short time you would soon die from suffocation. It will not help the burning up of the food stuff in the blood. It will readily burn itself in the air, so that it would be perfect madness to endeavour to extinguish a fire by throwing hydrogen upon it.	This gas is of no use as a drink in the pure state. You cannot set it on fire, but it supports combustion so greatly, that if you could be made to drink it the heat produced in your body would be so great that either the blood would boil or your flesh be roasted or set on fire. You see, therefore, that it would be perfect folly to try to put out a fire by throwing oxygen upon it.

47. Thus, then, you see that if you attempted to live upon either H or O, you would very soon die; yet that, after the two elements have undergone a chemical change, their properties become so wonderfully altered that in the form of water you can swallow many pounds of both of them, in the course of a year, without any harm arising.

CHAPTER IV.

Carbon. Symbol C. Combining weight 12.

48. This is the name given to another of the elements. It is a very remarkable body, perhaps the most remarkable of all the simple substances with which we are acquainted. It exists in three different forms, which are so unlike each other in their outward appearance, and also in their physical properties, that if I were not able to *prove* to you that they were one and the same element, you would require a most extraordinary faith in me to accept the fact; but facts are stubborn things, and when they are proved there is no getting over them.

49. Carbon differs from the things I have already brought under your notice by being a solid element. The three forms it assumes

are the diamond, graphite or plumbago, and charcoal.

50. That beautiful, sparkling, and of all gems the most precious and costly — the diamond —is simply carbon. Blacklead, out of which pencils are made, and with which the house-maid polishes the fire-grates, is simply carbon. Common charcoal, made by burning wood underground, as well as the soot which collects in the chimney or the glass of a lamp, is simply carbon.

51. How the black charcoal is changed in appearance into the bright, transparent precious stone, man has never yet been fully able to understand, nor has he ever been able to turn charcoal into diamonds; yet, on the other hand, he can easily turn a diamond into a black lump of charcoal, without adding anything to it or without taking anything away from it. You can imagine it is not a very profitable operation, and therefore not very often performed.

52. Not only is carbon a very remarkable and interesting element, but it is also a most mportant one. It enters into the composition of every animal, tree and plant on the face of the globe; and without it not one of these could exist as we now know them.

53. The number of things of which it forms a part is more numerous than all the other things in the world put together. You will, therefore, be quite prepared to hear that it forms a very important part in nearly all our solid food, nor will it surprise you when I tell you that it enters into the composition of all intoxicating drinks.

54. Coal, coke, soot, blacklead and wood-charcoal are all examples of carbon in its ordinary form, mixed more or less with impurities.

55. In this condition it is quite useless to us as a food, but, at the same time, it would not hurt us to swallow a great deal of it. Indeed, for some purposes, it is very useful when taken

into the stomach, but its action there is only what is called mechanical; it does not undergo any chemical change, and so get transformed into blood. What I want at this moment to impress upon you is, that in its pure state carbon is not a food, but at the same time it is not a poison, and that it might be swallowed in the form of charcoal or diamonds without any harm following.

56. The great chemist Nature takes carbon, mixes it up with a few other elements in all manner of remarkable ways and proportions, and makes them chemically combine, forming most wonderful compounds, and such a number of them, that if you were to live to be a hundred years old you would not be able to learn all of them. Everything made of wood, leather, or paper, and all sorts of clothing, contain carbon; indeed, it is hard to think of anything that does not contain it.

57. Some of the things that Nature thus manufactures are most innocent and useful as

food, and are most delicious to the taste. Bread, milk, meat, and all kinds of fruit and vegetables contain it. Then, on the other hand, some of the things which contain carbon are intensely disagreeable and nasty, and are frightful poisons.

58. You will please, therefore, understand that although nearly every food contains carbon, yet there is an immense number of things containing it which are not food, and that the mere fact of a body containing carbon tells us nothing as to whether it is fit to be taken into the body or not. This often has to be found out by experiment.

59. Carbon in the shape of charcoal possesses in a very great degree the power of absorbing gases, and of removing many poisonous substances from fluids that are made to pass through it. Owing to this property, it is very valuable, and is largely used for making filters, for purifying drinking water. It is also very useful to the scientific chemist.

60. When taken into the stomach, it absorbs many foul gases that are generated there, and thus corrects offensive breath, and is good for flatulence and indigestion.

CHAPTER V.

Intoxicating Drinks.

61. It is often very interesting to examine a word, to see how it has come into common use, and to find out what is its real meaning.

If we do this with the word 'intoxicating,' we shall find that it is derived from a Greek word through the Latin language, and that it means in English poisoning. Therefore, intoxicating drinks are really poisoning drinks.

62. A poison is a substance which, when taken into the body, produces a morbid and dangerous effect upon the life of the object under its influence.

It is not inevitable that a poison always kills the person who takes it, for you can

easily understand a person taking too small a quantity to produce that result. Yet, at the same time, the quantity in no way alters the fact that a poison is a dangerous thing, and should be left alone or handled with caution.

63. The term 'intoxicating drink' might very properly be applied to every drink that contained a poison of any description whatever, but custom has now limited the term to that class of drinks which contains only one particular kind of poison. There is an old proverb which says, 'Familiarity breeds contempt.' Now, it is a very singular fact, and an exact fulfilment of this saying, that has led society to use a whole host of these beverages with as much freedom and thoughtlessness as if they were as innocent as simple water, at the same time calling them by a name—'intoxicating'—which ought to make us stop and think, and not drink them unless there was some very strong reason for doing so. In-

deed, so common is the habit, that eight out of ten will deny that they are poisoning drinks, and many go so far as to declare that they are food.

64. All the different fluids which people drink under the names of spirits, wines, liqueurs, ales, etc., differ from each other in many ways, such as colour and taste and smell, and so on; but they all resemble each other in one particular, viz., in containing a poison. The poison is the same in all of them, and its name is Ethylic Alcohol; hence we have the common name intoxicating or alcoholic drinks applied to them.

65. If this poison, ethylic alcohol, were removed from the beverages, they would of course cease to be intoxicating, and might be drunk by teetotallers as well as other people.

The alcohol can easily be removed by boiling, but after it has been removed most of the drinks become so insipid or disagreeable

that few people care to drink them in this state, and they are looked upon with no more favour than a bottle of doctor's physic; hence it is pretty evident that they are taken simply and entirely on account of the poison, alcohol, which they contain. Though you are but children, and some of you not very wise, yet most of you have enough sense to feel that it cannot be right for people to get into the habit of drinking poison three or four times a day, even though they do not take it in sufficient quantities to kill them.

66. There is a peculiarity about all poisons, and it is this: If a person begins taking any kind of poison, by degrees he can go on increasing the quantity until he can take, without apparently injuring himself, enough to kill several people; this is especially the case with intoxicating drinks. A child, or a man even, who has never tasted them would be poisoned or made drunk with a wine-glassful of brandy; but a man or woman

who has been taking them for years can drink a pint without being made drunk. You must not think, however, that it does them no harm; it does them a great deal of injury—the more they take, the more the damage. Experiments have proved that even a small quantity taken regularly shortens a man's life a year or two.

67. It cannot be denied, however, if we are to believe the testimony of drinkers, that there is something very fascinating about these intoxicating beverages, and by degrees they get to like them so much that although they poison the system, and produce all sorts of diseases, many prefer to have their bodies injured, and to bear their diseases, than to give up drinking the things they so much enjoy. When this is the case, we cannot do much for them, as they very much resemble the individual who, convinced against his will, remains of the same opinion still. There is another, and a very large, class of people who drink

these beverages simply because it is the fashion to do so, who are quite ignorant of their real properties.

68. I wish to give you sound information to lead you, as sensible boys and girls, to avoid ever getting into the habit of taking them at all; or if this cannot be, that the responsibility may rest upon your own shoulders, who, knowing the right, choose to do the wrong.

69. Some of you may wonder where the alcohol comes from, or why it is put into the drinks, if it is such a dangerous thing. In the next chapter I propose giving you an account of alcohol, and, in the following five or six, to explain to you how it comes to be present in the chief beverages we speak of.

CHAPTER VI.

Alcohol C_2H_6O.

70. ALCOHOL is a compound body, made up of three elements, each of which I have already brought under your notice, viz., the two simple gases hydrogen and oxygen, and the solid element carbon; the three chemically unite together, forming a liquid substance which is quite colourless, bright and sparkling, and as transparent as water, from which, by its appearance only, you would not be able to distinguish it; it has a pleasant smell, but an irritating and burning taste.

71. There are several kinds of alcohol; they differ from each other in the amount of carbon and hydrogen they contain, but this alters them so thoroughly that they can never

be mistaken for each other, and are always spoken of by prefixing an adjective before the noun. The full name of the substance we are now dealing with is Ethylic-Alcohol (you may easily recollect that, as it is very much like an old Saxon and very pretty name of a girl—Ethel), but because it is so much more common and generally used than any of the other alcohols, it has become customary to speak of it simply as alcohol, and whenever in the future the simple word alcohol is used, the ethylic-alcohol is understood. It was also the only alcohol known for many years after its discovery.

Alcohol is a word of Arabic origin. The Arabs were, in their day, great chemists, and amongst their researches and experiments they brought into use the art of distillation; that is, of separating one fluid from another by means of heat: and in this way amongst their investigations they discovered and sepa-

rated alcohol from the fluid with which it was mixed.

72. A pound of alcohol is made up of

8·347	ounces	of carbon
2·086	„	„ hydrogen
5·565	„	„ oxygen
15·998		

You must not suppose, however, that it can be made by weighing out these quantities and mixing them together in a bottle; you might do this, and shake them up till you were tired, but you would only make a *mechanical mixture*, which I have previously tried to make you understand is a totally different thing to a chemical compound, made after the same ingredients have undergone a chemical change.

73. How then, do you ask, is this substance made? As far as the investigations and experiments of chemists and wise men have been carried, up to the present time, they have only been able to discover one method

by, or source from, which they can obtain alcohol; and that one is the destruction, or rather decomposition, of sugar. The useful, pleasant, and harmless sugar, so familiar to all of you, is broken up by a process called fermentation into two poisons, viz., alcohol and carbonic acid gas.

74. If you were to search from the north-pole to the equator, and from the equator to the south-pole, with all the districts lying between them, east and west, you would not find any spot where alcohol is produced by any other means; you would find neither lakes, nor rivers, nor springs, nor mines of alcohol; you would find no trees, or plants, or fruits, or flowers growing alcohol: indeed, you might search the whole world throughout, but neither in the clouds above, nor in the waters beneath, will you find alcohol. By this, I mean, it is never produced naturally, and cannot, like corn and fruits and vegetables, be called a good creature of God.

When I say that in your search for alcohol you will never find it produced by nature, I wish to qualify the statement by saying that you might find it in very small quantities in *contact* with some fruits; but this is only the case when such fruits have been exposed to certain conditions, and are in a state of decay; that is, have become over-ripe and begun to rot way.

Even in this case it cannot be called a natural production, for it was never the object of the plant to produce alcohol. The quantity formed in this way, however, is so exceedingly small, that it is hardly worth taking any account of it.

75. Sugar is formed by the great chemist, Nature, in the juices of many plants and of most fruits; and from these sources it may easily be converted into alcohol. However, it so happens that the greater part of alcohol is not made *directly* from sugar, because, though it would be the simplest method, it is not the cheapest.

Sugar is not only naturally produced, but can be artificially manufactured by man out of starch—a substance made of carbon, hydrogen and oxygen, and contained in wheat and barley, potatoes, and many other things. These being very cheap compared with sugar, it comes to pass that the greater part of alcohol is manufactured from some kind of grain, the starch of the grain being first converted into sugar, the sugar thus formed being afterwards decomposed into alcohol and carbonic acid gas. So that, though in reality alcohol can only be made from sugar, indirectly it can be made from many things; in fact, from anything containing sugar, or anything capable of being turned into sugar.

76. Here I wish to give you a caution, lest you should fall into a very common error. There are some people who are silly enough to tell you that because all alcohol is made from sugar, therefore sugar *must contain* alcohol, and that if you wish to avoid *it*, you

should not eat sugar, because in so doing you would be taking alcohol. By this time I hope you are all chemists enough to understand that there is no *must* in the matter, and that such reasoning is very bad logic. The sugar no more contains alcohol, than your coat is a piece of paper, because paper can be made out of rags; or that a forest of trees is a coal-mine, because coal is made out of wood; or that grass is butter and cheese.

The manufacture of alcohol out of sugar is simply another example of the innumerable wonders of a chemical change—a change by which new products are formed by a re-arrangement of the elements, having totally different properties from the substances out of which they are made.

CHAPTER VII.

Alcohol—*continued.*

77. ALCOHOL is an acrid narcotic poison. When taken into the stomach, it becomes rapidly absorbed by the blood, which by the action of the heart is being rapidly distributed and circulated along the veins and arteries all over the body. If you place your hand on the left side of your chest, you will feel the heart beating. In an ordinary healthy and adult man it beats about seventy-three times in a minute, or $73 \times 60 = 4{,}380$ times in an hour. The effect of introducing alcohol into the system is to make the heart beat quicker, the rate at which it goes depending upon the amount of alcohol introduced.

This more rapid movement of the heart

sends an unnatural amount of warm blood towards the external parts of the body, the effect of which is to give the individual the *feeling* of extra warmth. The face becomes flushed, the eye brighter, and the whole being of the man livelier.

78. This state very naturally gave rise to the belief that alcohol warmed the body, and this idea was strongly advocated for many years. It very forcibly illustrates what the wise man, Solomon, meant when he said, 'Wine is a mocker.' Researches have shown, and especially those of Dr. B. W. Richardson, that alcohol, instead of warming the body, actually makes it colder. It is true that for a time there is not only the feeling of extra warmth near the surface of the skin, but that those parts really are warmer. But it is only a removal of heat from one part of the body to another, from the inner to the outer parts; and as the outer are exposed to the air, the heat radiates off, and finally leaves the body

colder, the degree of cold produced depending upon the amount of alcohol taken.

79. Owing to the fact that alcohol makes the heart beat quicker, it is called a stimulant; but its stimulating effect is always followed by a reaction, and if the supposed benefit is to be kept up, it is necessary to repeat the dose, and in this repetition many injurious conditions are brought about in the tissues of the body, and a question of great importance arises as to the wisdom of introducing it into the system at all.

80. A stimulant is something that rouses up or draws forth the reserve force of the body, makes us use it up quicker; thus the boy or girl who runs, gets tired sooner than the one who walks, because in the same time more force has been used up, and a longer distance covered. If an animal with a heavy load is going up a hill slowly, the driver often uses the whip or spur; the animal puts forth more effort, and accomplishes his task more quickly: but

before he reaches the top of the incline he probably flags again, and if the driver continues to apply the whip the horse will soon become quite exhausted, and unable to go any farther. The whip acted as a stimulant, drew out the horse's hidden strength, but supplied no new strength.

This is exactly the case with alcohol, it stimulates or draws out, but supplies no strength. The human body is such a wonderful and complex machine that it is very difficult in a few sentences to convey to you anything like the whole influence exerted over it by alcohol, because if I were to talk in learned or scientific language, you would probably not understand me.

81. I have told you that generally the heart beats about seventy-three times in a minute; when alcohol is introduced into the system this rate is sometimes increased to as high a rate as ninety beats in a minute. This at first sight may not seem of much consequence to you, but

you will better understand it as we go along. The heart beats incessantly both when we are awake and when we are asleep, and it causes the blood to travel all over the body a great many times; the effort of doing which is made plainer by saying that it is equal to lifting a ton weight 115 feet high. This is its natural work; but when about three ounces of alcohol have been drunk, the heart has to work so much harder, that the work done by it is equal to lifting one ton 125 feet high, that is ten feet higher than its natural work; or, to put it in a still simpler way, it means lifting ten tons one foot high, or 220 cwt. one foot high, or 24,640 lbs. one foot high in twenty-four hours. That is rather more than lifting one pound a thousand times an hour. Which of you, I should like to know, would be glad to have this work imposed upon you? Why, your hands could hardly do it, and you would soon be exhausted and faint under the task. Even though a slave-master stood over you

and lashed you with his whip, you could not continue long at such hard work; the effect of the stimulus would soon cease, all your reserve force would be drawn out of you, and unless it were renewed by rest and nourishing food you would drop down utterly worn out.

Can you wonder, then, that the heart soon begins to flag under the cruel tyrant alcohol? It does so, and although continued doses will fetch out all its hidden powers, they would soon be quite exhausted; but beyond a certain point it cannot go, for death would arise from over-stimulation.

82. At the same time that alcohol is thus acting upon the heart, it is also affecting other parts of the body injuriously. In the blood are a number of very important little bodies, called corpuscles. Alcohol has a great affinity for water; it extracts the water from these corpuscles, and causes them to dry up and adhere together, forming hard clots, which often hinder the free circulation of the

blood and become a source of considerable danger.

83. When alcohol is taken in anything like large quantities, it very greatly retards the process of digestion. By digestion is meant the changes by which the food we eat is converted into nourishing blood. In its full extent it is a comprehensive and difficult subject to make you understand; nor is this necessary for the purpose in view at present. Suffice it to say, that immediately the food is swallowed it enters a cavity, or sack, called the stomach, where it soon becomes acted upon by a substance called gastric juice. Now, the gastric juice is a compound fluid generated by the glands of the coats of the stomach; one of the most important ingredients of which is a substance to which the name of pepsin has been given.

84. Upon this most important body, alcohol has a specific and direct action, viz., that of rendering it useless for the purpose for which it is intended to fulfil. And if the quantity of

alcohol be large, it prevents the food, for a considerable time, undergoing the proper changes, because it comes into immediate contact with the latter as soon as it enters the stomach, and in this way digestion is considerably retarded instead of, as many suppose, aided by the introduction of alcohol.

85. Fortunately for the body, alcohol feels itself to be a very foreign substance, and it acts like a culprit that knows it has no business there, and endeavours to depart as quickly as it can. Unlike most things that are introduced into the stomach, alcohol has the power of leaving it by a much shorter and quicker method than ordinary foods; nor, like them, does it need to be chemically decomposed or digested, but is at once absorbed from the stomach into the blood, and carried by it in its circulation all over the body in a few moments. Thus, almost before you are aware you have swallowed a glass of wine, a portion of the alcohol may be in contact with

your brain or in the liver, and the next moment in a muscle of your arm, or rushing along the arteries in your feet; and wherever it can get a chance it escapes from the body, as in the breath and in the perspiration, in an unchanged condition.

86. There is a great deal of contradiction and dispute amongst learned men as to how much of the alcohol taken into it, the body able to get rid of without its being decomposed and used up in the system; nor are they able to agree among themselves as to the manner in which that portion of it which is chemically changed is made use of. At one time it was thought that it supplied force, but that idea is now exploded: then it was argued that it was turned into fat and helped to keep the body warm, but that theory has been proved to be quite false.

So, whilst these men of science are experimenting and trying to find out the truth, we can afford to wait patiently and learn the

result of their researches by-and-by. But in reality this controversy is of little consequence to us, because, though the sages cannot agree among themselves in finding out any useful purpose that the habitual taking of alcohol performs, they are quite unanimous in attributing to it a whole host of evils.

87. I told you it got very rapidly distributed all over the system, flying about with the same quickness as the blood circulates; yet such a powerful enemy is it, that though it stays so short a time in any one place, and gets out of the body as quickly as it can, wherever it goes it leaves its mark behind, and injures every organ of the body it comes in contact with. The coats of the stomach, the liver, heart, brain, lungs, kidneys, etc., all come in for a share in the damage.

Some of the most painful and trying diseases are produced by it, many of which are brought on so gradually that their true cause has often been overlooked. Especially is this

the case with those people who seldom or never get drunk, and are looked upon as very moderate, if not model, drinkers. In the long-run, some special organ which is more delicate in one person than another gives way first, and then a chronic sort of disease is set up. In one individual it is indigestion, in another lung disease, and in a third person the heart gets out of order. Indeed, there is no one single thing that man indulges in that produces so many diseases as alcohol.

88. Alcohol is not only poisonous to man, but it acts in a similar manner upon all animals; and on plants it acts as a rapid and fatal poison. In this way it differs from such poisons as opium, belladonna, and tobacco, which can be taken by some animals without any harm following, in quantities large enough to kill several people. Alcohol, however, seems to blight or destroy every living thing it comes in contact with.

CHAPTER VIII.

Alcohol—*continued.*

89. Despite all that has been said, alcohol is a very useful body, and the world would be put to great inconvenience without it.

It simply wants keeping in its proper places, and put to its legitimate purposes. It will then be interesting to inquire what qualities entitle it to respect and honourable mention.

90. Like water, alcohol has an immense solvent power; and, strange to say, many of the things that water will not act upon are readily dissolved by alcohol, and for this purpose alcohol becomes to the scientific chemist, as also in the arts and manufactures, a substance of immense utility. Then, again, it has the property of remaining in an unchanged

condition for years and years, and not only will it remain thus itself, but also it prevents the substances with which it comes in contact undergoing decomposition; thus it is that it is used very largely by the druggist for the manufacture of tinctures, in which the active and medicinal properties of many drugs are brought into a state convenient to be used as medicines, and in such a condition that the preparations will keep good a long time, whilst if they were made with water they would spoil in a few days.

91. Besides this, it is used as an agent in the preparation of many things, such as chloroform, ether, and other similar chemicals, which, in the hands of the physician and surgeon, may be classed amongst the greatest boons of this age of civilisation to suffering men and women.

92. Owing to its antiseptic properties (that is, its power of preventing bodies undergoing decay or becoming rotten), it is most useful

for preserving specimens of all kinds of animal matter, which specimens often become objects of great curiosity and of inestimable value to the medical and zoological student.

If you were to visit the museum of any of our large hospitals, you might see a large number of bottles containing specimens of all sorts of dead animals, and of the different parts of the human body, immersed in a fluid. This fluid is alcohol, and they are preserved perfectly for a great many years by this means. Now, when a person eats a meat dinner, and then drinks a glass of wine, or brandy and water, the alcohol in either of them acts in exactly the same way. It renders the meat hard, and prevents it digesting.

Fortunately for us, however, our stomachs are not exactly like a tightly-stoppered glass bottle, for the alcohol gets out of it as quickly as it can; and besides this, there is a force acting within our bodies which it is very difficult either to define or understand. This force

is called *vital force.* It very considerably upsets our theories about many things, and greatly tends to lessen the evils that would otherwise arise from the introduction of many things into the stomach.

93. Varnish and French polish, two things which add very greatly to the beauty of the painter's and cabinet-maker's work, are made with alcohol. Owing also to the fact that it burns so freely, giving out great heat, but with a smokeless flame, it is very useful for many purposes where no oils or gas are under ordinary circumstances suitable.

94. Alcohol has never yet been frozen, and for this reason it is used for filling thermometers when experiments with artificial cold are being carried on.

95. Much more might be said in favour of 'old King Alcohol;' and by justly weighing the evidence for and against him, it would be found that, after all, he is a very good fellow when kept in his proper place.

The proper places for alcohol are the shelves of the druggists' shop, whence it should be removed, under the advice of the physicians, with us much care and watchfulness as laudanum, chloroform, and other deadly poisons, which almost make you shudder to have anything to do with.

96. Again, alcohol is in its proper place when it is kept in the laboratory of the scientific or manufacturing chemist, and employed by him as a valuable agent in the prosecution of his useful calling. There are other places also of lesser importance, where it is quite at home.

But the moment it is put into the hands of the people, almost thrust upon them at nearly every corner of the streets, from gin-palaces, wine-shops and beer-houses, with a view of its being swallowed by them with as much freedom as though it were as useful and as innocent as water or milk, then it is that it is altogether out of its place, ceases to be per-

forming any good or useful purpose to mankind, and immediately becomes an agent of terrible devastation, producing sin, misery and disease.

97. There are many who will tell you that it is the abuse, and not the use, of alcohol that is so much to be deplored. They will tell you that God's greatest blessings, by being *abused*, may be turned into curses; but the moment alcohol is taken into the system as a beverage, it is put into a wrong channel. And the alcohol itself proves this by beginning to abuse the body and upset all its organs, often making some of its members abuse other people.

98. There was a time when few people knew anything about the real action of alcohol upon the human system, and all the evil effects that followed the drinking of intoxicating beverages were supposed to be due to adulteration.

You and I happily live under a brighter

light. We know in a measure that the natural action of alcohol on a living body, under ordinary circumstances, is to injure and to kill it. *We*, then, not the alcohol, are to be blamed if we employ it for a purpose for which we know that it is not only not suited, but for which it is very unsuitable. We act with about as much wisdom as he who lets loose a mad dog amongst a crowd of children, or as one who attempts to extinguish a fire by pouring burning pitch upon it.

CHAPTER IX.

Malt Liquors.

99. The intoxicating beverages of commerce may be conveniently divided into three classes, viz., 1. Malt Liquors; 2. Wines; and 3. Spirits.

100. Each of these differs from the other in several important particulars: the sources from whence they are manufactured, the processes by which, as well as the object for which, they are made.

101. Malt liquors and wines are the result of a process called vinous fermentation.

The term fermentation has been given to a very interesting class of changes or decompositions which certain substances are capable of undergoing. The change that is effected is different from, though very like, a chemical

change. Experiments and observations have shown that the process depends upon the presence of living organisms, to which the name of *ferments* have been given. Different kinds of ferments give rise to different results, and thus it comes to pass that we have several kinds of fermentations. The fermentation that we have to do with in the manufacture of intoxicating drinks is called vinous or alcoholic fermentation, from the Latin word *vinum* (wine), because it represents the process by which all wines containing alcohol are formed.

102. It is found that when a solution of pure sugar in water is exposed to the air, it remains unchanged for a long time; but if a little matter called yeast be introduced into it, a change very rapidly takes place. The sugar becomes split up, the elements carbon, hydrogen and oxygen, of which it is composed, being re-arranged, form a new liquid, *alcohol,* and a gas called *carbonic acid.* This

latter escapes in little bubbles, and gives to the entire liquid the appearance of boiling. Hence arises the term fermentation, which really means boiling.

103. Under the name of malt liquors, we include beer, ale, porter and stout. They differ from each other only in minor importance, and are all manufactured by a process to which the name of *brewing* is given.

104. The process of brewing is very simple in theory, it being simply the changing of the starch of grain into a sugary solution, and a further conversion of this solution into an alcoholic beverage; but for the successful carrying out it requires much care and experience.

The three chief things employed are water, malt and hops. Water I have already brought under your notice.

105. Malt is manufactured from barley. Its manufacture forms a distinct trade, the man who carries it on being called a maltster. The

barley is sent to the maltster, who, in suitable premises, damps it with water, and keeps it in a moist state until it begins to grow, or throw out little rootlets. It is then spread out in layers upon the floors of warm rooms, called kilns, where by means of heat all the moisture is driven off, and the growth that had begun is stopped.

During the damping process a peculiar substance is formed, to which the name of diastase is given. It has the property of converting the starch into sugar; hence it is that malt is sweet to the palate when tasted. The whole of the starch might be converted into sugar, but the presence of water is needed for the change, and the whole of this has been driven off by the heat of the kiln.

There are two kinds of malt, a pale one and a dark one. They are the same thing, and prepared in the same way, the dark colour being produced by simply heating it at a higher temperature. In fact, it is slightly

burnt, and may be well represented by a piece of toast or burnt bread, while the pale kind would answer to a baker's loaf. The pale kind is used for making ales and beers, the dark kind for brewing porters and stouts. The malt in its present state is a very good food, but it is no better than the barley from which it was made—indeed, not quite so good. However, time and labour have been employed in making it, and out of six pounds of barley barely five pounds of malt can be manufactured; hence it becomes dearer in price.

106. The brewer buys the malt. We will now very briefly follow him in the manufacture of his beverages.

The malt is ground or crushed, the brown malt for porters being generally crushed finer than the pale malt. It is then placed in a wooden vessel, varying in size according to the quantity of malt to be wetted, having two holes at the bottom. The vessel is called the mash-tub. Hot water is now poured upon it,

and the grist, or ground malt, is ultimately mixed with the water and stirred about for a considerable time. After a while the taps are opened, and the fluid portion allowed to run out into a vessel, whence it is pumped or otherwise conveyed to the copper for boiling. When most of it is drained off, more hot water is added to the grains in the mash-tub, the same process being repeated a third time.

107. To this new fluid the name wort—sweet wort—has been given. In what does it differ from the hot water? Simply in this. I told you that in the making of malt a substance called diastase was formed. Now when the hot water is added, this diastase acts upon the starch, and converts nearly the whole of it into sugar, which is readily dissolved by the hot water; and when the taps are turned the solution of sugar runs out. The water carries away with it a few other things, which give colour and flavour to the wort.

These other things, however, are of little importance; the less the brewer gets of them the better is he pleased. The only object he has in view is to get as much starch as possible turned into sugar. He has to be very careful about the temperature of his water. He never uses it quite boiling, because if he were to do this the starch, instead of being turned into sugar, would swell up and thicken in the mash-tub, just as starch does when your mother pours boiling water upon it for stiffening linen. It would not run out at the bottom of the tub, but would make a good nourishing malt-pudding, suitable for fattening either men or cattle: but he would have quite defeated his object.

108. The sweet wort is now in the copper, hops are added to it, and then the mixture is gradually made to boil; when it has been boiled long enough to get the bitter principle out of the hops, they are strained out, and the boiled wort run into vessels called coolers.

The coolers are large shallow vessels, and are generally placed in the most open part of the brewery, so that a free current of air may pass over their surface. Great injury arises to the wort if it is allowed to remain very long in the coolers, especially in summer-time; it is therefore often artificially cooled by fans and refrigerators. So large are these operations in some breweries, that it is found economical to have machinery on the premises for the manufacture of ice for this cooling process.

109. The next operation is that of fermentation. It is carried on in a vessel called a gyle or fermenting tun. Into this vessel the wort is conducted from the cooler, and when sufficient has entered it is intimately mixed with *yeast*.

By the action of the yeast the sugar is converted into alcohol and carbonic acid gas. When enough alcohol has been formed, the yeast is withdrawn and the fermentation stopped.

It is then packed in casks for sale as ale, or run into large vats, where it deposits nearly all the solid matter suspended in it.

110. The last operation the beer has to undergo is that of fining, or clearing. Isinglass or other gelatinous matter, dissolved in sour beer, is added to the new ale or beer; this collects together all the lighter floating particles which render the beer thick and cloudy, and by degrees they fall together to the bottom of the vessel, leaving the beer clear and transparent.

111. This is how what is called pure, good home-brewed, or unadulterated beer is manufactured; this is the stuff many people think cannot do any harm, because it was made from pure malt and hops.

I hope you clearly see and understand that both the sugar and the alcohol were produced *from* the starch of the barley, and that they were not *in it* in the first place.

The various kinds of ale and porter, etc.,

differ from each other very little; their colour and flavour being given to them by simple and artificial means. The difference in their value, either as an article of food or medicine, is not worth a snap of the fingers.

CHAPTER X.

Malt Liquors—*continued.*

112. It will be interesting for a few minutes to take a gallon of ale and compare it with the barley required to make it, and see in what respect they resemble each other.

113. In order to make a gallon of ale, six pounds of barley is required; this, by the process of malting, is reduced to four and three-quarter pounds of malt; and all the solid matter that is got out of the malt by the hot water in the mash-tub is one pound, which, by the process of fermentation and after refining, is lessened still further, to such an extent that the best ales or porters do not contain more than half a pound of solid matter in the gallon. And thus it comes to pass that

a gallon of ale which weighs ten pounds is made up of

½ lb. of solid matter, or extract
½ lb. of alcohol
9 lbs. of water.

That is to say, six pounds of good solid barley have become reduced to half a pound of solid extract, and the brewer is obliged to charge you more for this half pound of solid extract than the corn-merchant would for six pounds of barley.

You could buy six pounds of barley for ninepence, whilst you would have to pay eighteenpence or two shillings for a gallon of ale.

114. But before we pronounce judgment upon the wisdom or folly of such a step, we ought to inquire and find out what are the properties of the solid matter contained in beer, etc. You might say to me, Is it not a condensed extract of all the important and useful parts of the malt, and therefore much

more valuable than an equal quantity of malt or barley? No, it is not. It is far from this—it contains a small amount of sugary matter, gum, and some of the saline salts of or barley that are soluble in hot water, but the best part of the malt is left behind in the mash-tub; this receives the name of grains, and is sold for fattening cattle and pigs.

You recollect that it was not boiling water that was used to make the sweet wort, but merely hot water; the result of the process being something like what would happen if your mother were to soak a leg of mutton in a pot of hot water, throw away the meat to the dogs, and try to live on the greasy water, calling it nutritious soup. The hot water would not dissolve out the nutritious and valuable parts of the mutton; in order to do that, and to make a good soup or stew, the meat must not only be soaked but cooked for a long time.

115. I do not mean to say that the solid

matter in the beer is quite useless as a food. Nothing is gained by a departure from strict truth. The bitter extract, the gum and the sugar, are to a certain extent useful. Of late years it has been shown also that porters and stouts retain some of the diastase of the malt. Now this diastase is useful in helping to turn many of the starchy foods that are eaten into sugar, thus indirectly helping to warm and fatten the body; and so, long before the reason was actually known, porter and stout had gained a high reputation for nourishing qualities, and were considered to be very valuable to nursing mothers and others who required much support. Even here, I hope you see that they act merely as medicines, and that it is *not* the porter or stout themselves that contain the nourishment; they merely help to get it out of other food stuffs. On the other hand, this solid matter is very injurious when continued for a long time. The effect upon the human

body being to produce gout and rheumatism, and this accounts for a great many beer and stout drinkers being sadly affected with these two painful diseases. But supposing they had no bad qualities, it is a fact that the good ones they possess are not equal to the merits of the simple and unchanged barley. If this is the case, how stupid and extravagant for anyone to go and pay two shillings or one and sixpence for half a pound of this food, when he can get six pounds of the same kind in a much purer and more wholesome state for ninepence; that is, he may get twelve times the quantity for half the price. In other words, he pays two shillings for one pennyworth of stuff; and so we might prove that a penny loaf would contain as much nourishment as a gallon of ale.

CHAPTER XI.

Malt Liquors—*continued*.

116. I SPOKE to you of the usefulness of the diastase; now a thimbleful of diastase in the pure state would be more useful than all the solid matter of two or three gallons of ale; and besides this, people who are in fairly good health are able to digest and convert all their food into blood and flesh without the aid of any such extra and artificial means. However, I am able to assure you that it is not on account of the solid matter contained in them that people drink these malt liquors, but *because there is something fascinating about them, something that makes the drinker light and sprightly, and gives him pleasure.*

117. It is the alcohol they contain that gives them this charm. There is about half a pound of this spirit in a gallon. You know all about the injurious effect of alcohol on the body, and of the folly of taking it into the system at all as a beverage.

118. Still, many things that are dangerous in the ordinary way have a very useful part to play when used as medicines on a diseased state of the body. For a moment we will suppose ourselves ill, and that the doctor has recommended us to take malt liquors. He says we *must* take them, or he will not answer for our getting well. We have a great objection to take them, and, as a common-sense patient, we ask him *why* we *must* take them? what is the particular effect he wishes them to produce, and which part of the beer it is that will bring about his object? If he be a thorough master of his profession he ought to be able to give a satisfactory reply to each question, but in a great many cases he would not,

because few medical men have made a special study of beer, etc., and the majority merely order them from a careless habit they have got into. In the first place, it seems strange that a doctor should send you to a public-house or brewery for his medicine; most people suppose that the doctor's surgery or the druggist's shop is the place where medicines are sold.

119. If he tells you it is the alcohol he wants you to have, you might suggest that it be given in the pure state, carefully measured out in accurate doses by his dispenser.

120. If it be the bitter of the hops he wishes you to have, you might ask to be allowed to buy hops and make hop tea, by pouring boiling water upon them at home.

121. If he should say the sugary matter was important, you might hint that it would be far pleasanter to take a teaspoonful of sugar now and then, without having it mixed with the nasty bitter extract.

122. If he were then to inform you that it was the bitter extract that he principally wanted you to have, to give an appetite and tone to the stomach, we might respectfully ask him to send it in the form of pills, as he does most other extracts.

123. It is really a disgrace to the medical profession, that with all the hundreds of medicines they have at their command, a large number of them pretend they cannot order or make up some other thing as good for their patients as the brewer can. Indeed, when the subject is sensibly looked into, it is merely a lot of moonshine or rubbish; they *could* do without it as easily as you can say your A B C, if they liked.

124. Not one or all the doctors in existence would convince me that there was nothing else in the world but malt liquors that would cure me because I was in such and such a state *unless they could give a more satisfactory reason for my taking them than I have ever yet heard.*

I would not object to take their malt, or their hops, or their alcohol, but I would not take their brewer's beer.

125. I do not mean to say that in some cases the beer would not do good; indeed, I fully believe it often would; all I mean to say is, that a clever doctor could make up something as good or better, and that there are many reasons why he should do so, and also many reasons why we all should set our faces staunchly against brewer's physic.

CHAPTER XII.

Malt Liquors—*continued.*

126. The art of brewing and the use of beer was known in very remote ages amongst the northern nations, and it was the favourite drink of the Anglo-Saxons and Danes, as it had been of their ancestors the Germans. After the introduction of agriculture into this country, malt liquors were substituted for mead, and became the most general drink of the Ancient Britons. In those days, however, beer was made without hops, and was very weak in alcohol.

127. A few figures will give you some idea of the greatness of the trade that is now carried on by some of the leading brewers: Messrs. Truman, Hanbury, and Buxton

(London) use 175,000 quarters of malt, 18,000 cwt. of hops, and 9,000 tons of coal every year, and 250,000 gallons of water every day. They produce about 500,000 barrels of ale annually. At Messrs. Guiness's (Dublin), 1,500 cwt. of malt are consumed daily, and there are 85 vats; some with a capacity of 100,000 gallons each. At Bass and Sons (Burton-on-Trent), 60 acres of land are covered with the works, and on it there are five miles of railway from one part of the building to another. 190,000 cwt. of malt are consumed annually, the produce of 42,000 acres of barlev land. The quantity of coal used during the chief brewing months is 160 tons *per day*. The sum paid in malt-duty is £200,000. The wages paid the men amount to £100,000 per annum. About 500,000 casks of different kinds are employed.

128. Ale brewing is also very extensively carried on in Scotland.

129. In 1877 there were in the United

Kingdom 28,000 persons paying for licences as common brewers. The cost of the licence is threepence per barrel.

In 1876 58,000,000 bushels of malt were used, which yielded a revenue to the Government of £7,500,000.

130. Seeing that the trade in malt liquors is so vast, that there are nearly 30,000 manufacturers of them, besides the great number of workmen whom they employ, to which must be added also a very large number of people who sell their productions, all of whom gain their livelihood and support their families out of this one trade alone, we might very naturally imagine that it was a most valuable one —one that was a great blessing to the country at large, because it made money pass so freely from one person to another, and found employment for such a large number of individuals.

131. The Saviour said, "A tree is known by its fruit." If we examine carefully the manu-

facture of malt liquors, and the results that flow therefrom, I think it will be quite plain, even to boys and girls, that instead of being a blessing, it is a curse to the country. If I can prove this to you, the very vastness of the business, the large amount of money invested in it, and the number of men employed in it, only magnify the evil, and add to the folly of allowing it to go on.

CHAPTER XIII.

Wines.

132. The term wine was no doubt originally applied to the simple expressed juice of the grape. The frequent reference made to it in the early history of the world, both in the Bible and in the writings of profane historians, fully justifies us in forming this opinion. And, unto the present day, there are a large number of people who maintain that the pure juice of the grape is properly called wine still.

133. By the term pure or simple juice I mean the juice in its unaltered or natural state, just as it is pressed out of the grapes, either with the hand, as it was into the goblet by Pharaoh's cup-bearer, or as it runs into the vats from the wine-press.

In this state, of course, it contains nothing but what exists in the grapes themselves as they hang in the cluster on the vine, and drinking wine of this kind is very much the same thing as eating the fresh and ripe grapes. The juice is merely divested of the skins, and separated from the stones or seeds, and so brought into a state more convenient for drinking. In this state it is unfermented, and contains no alcohol; and as alcohol is the only thing teetotalers fight against, this new or unfermented wine may be freely drank by abstainers as well as other people.

134. In the present day the term wine embraces a much larger class of beverages than those obtained from grapes; and it has come to be a generic term for the fermented juice of almost any kind of fruit containing sugar: thus it is we have currant, orange, gooseberry, elderberry wines, and so on. Indeed it is carried even beyond this, and artificial compounds are made, containing a small amount

of alcohol, receiving their names from the chief flavouring substance used, of which class ginger wine is a familiar example.

Cider and perry, which are merely the fermented juices of apples and pears, properly speaking, should be classed with wines.

135. Just as there are several kinds of currants, as red, black, and white currants, so there is an immense number of sorts of grapes; those of one country or district differing from those of another both in their size, colour, and delicacy of flavour: hence it arises that of genuine wines manufactured from the grape there are an immense number, each receiving its name either from the species of grape or from the district in which they grew.

136. Just as the fruit which is reared under the skill and care of a good gardener is better, more delicious to the taste, and pleasant to the eye, than that which grows wild, so there is a great difference in the grapes grown for making wine; and it naturally follows that the ex-

pressed juice of one kind would be more acceptable to the palate than another, and would consequently fetch a higher price in the market.

137. The process of wine-making is as simple as the manufacture of malt liquors its chief details are included in the following outlines:—The fruit is pressed in vessels suitable for the purpose; the juice that runs out is collected, filtered, and set aside in a rather warm place. It begins to ferment, the sugar which was in the juice becomes decomposed, and changed into carbonic acid gas and alcohol, the latter remaining in the fluid and the gas escaping into the air. But this is not the only change that takes place. The grape juice contains in solution, besides the sugar, several saline salts which are most useful, making the grapes not only grateful to the taste, but very beneficial as a thirst-quencher. Among these salts the most abundant and important is one called acid tartrate of potash, or, in simple language, cream of

tartar; a white powder that some of you no doubt have often fetched from the druggist's shop, as it is largely used in summer-time for making ginger-beer and other refreshing beverages.

138. Now cream of tartar is soluble in the natural grape juice, but it will not dissolve in alcohol; and as the sugar of the grapes is turned into alcohol by fermentation the cream of tartar is thrown down, and collects in hard lumps all round the sides and bottom of the vessel. It is from this source that all the cream of tartar and the tartaric acid of commerce is obtained.

139. Now I hope you plainly see what has happened. A chemical change has taken place; the sugar has been changed into alcohol, and another of the most important ingredients has been got rid of altogether, so that the fermented wine is a very different thing to the grape juice with which we started. Now it might so happen that a chemical

change should have improved its qualities; the question is, has it done so? We have already learnt sufficient about the poison alcohol to know that its presence is no recommendation; the loss of sugar and of cream of tartar, and of some other solids of the grape juice, is a considerable disadvantage. Indeed, the result of the operation performed is to so considerably alter the grape juice that the wine very little more resembles it than beer does malt and hops.

140. We all know that wines are looked upon by a large number of people as possessing wonderful properties, and, unfortunately, they are recommended by a great many doctors as being most valuable supports, and very nourishing and strengthening to delicate people, and to invalids recovering from an illness.

141. In these days of general education and popular science, it is not sufficient for such assertions to be made only; nor are we

going to hold as infallible, traditions that have been handed down to us by our fathers simply because they have been believed in for many generations. In both cases we ask for proofs, and if the subject will not bear the light of *truth* and scientific investigation we refuse to bow. Therefore, when these worthy people speak so enthusiastically about wine and its virtues in nearly all the ills that flesh is heir to, we respectfully ask them what it is in the wine that does so much good? If it was contained in the grape juice before fermentation, would not eating the grapes answer every purpose?

CHAPTER XIV.

Wines—*continued.*

142. An analysis of a great many wines discloses a very small amount of solid matter, and in most cases the greater part of this is found to be sugar. Now when we compare together the cheapness of sugar and the dearness of wine, it seems a great folly to spend our money in such an extravagant manner.

143. The finest port wine contains about five per cent., and old sherry about half that quantity, of solid matter; that is, a pint of port wine contains about one ounce of solid matter, and the same quantity of sherry about half an ounce. Some of the sweet wines contain a great deal more, but in these cases

the greater part is sugar; for instance, champagne contains twelve and a half per cent., but ten and a half parts of it are sugar. Now a quart of champagne costs seven shillings and sixpence, and it contains less than four ounces of sugar, which can be bought at a shop for a penny. These three wines, port, sherry and champagne, are very good samples of all the wines made from grapes. It takes about a couple of pounds of grapes to make a quart of wine; the grapes may be bought for a shilling; they become so changed by being turned into wine that their value as a food is nearly all lost, but a very large amount of money is charged for their manufacture. If the sugar is the only part of the wine worth buying, and a simple sum in arithmetic would show in obtaining it in this manner from the wine merchant, as much as forty shillings a pound is often paid for it, do you wonder that I deem people so acting to be very foolish?

144. Perhaps you tell me I have forgotten

the alcohol and the other things besides sugar that are in the wine. The alcohol as an article of food is useless; and you have already learned so much of its dangerous character, that I am certain you will agree with me that it would be better for the drinkers if it were not there at all.

The other solid matters that are found in fermented wines are so small and unimportant, that it is no exaggeration to say that, as far as food is concerned, a pennyworth of raisins or dried grapes contains more nourishment than five or six shillings' worth of wine.

145. The amount of alcohol differs very greatly, some wines, as currant and elderberry, not having more than one ounce in a pint; some of the French and German wines have two ounces of alcohol in a pint; whilst the ports, sherries, and Madeiras contain between three and four ounces of alcohol in each pint. These quantities represent the amount of alcohol that may be properly formed in

them in their legitimate manufacture from the fruits. By a little calculation it could be shown you how much sugar was required to form these quantities of alcohol, and you would then see how completely the grape juice was altered.

146. Now it so happens that in wines, as in malt liquors, the chief thing that the drinker prizes is the alcohol. When a person *commences* drinking wines he generally prefers the weaker ones; but in the course of time the drinker's system becomes so used to the effect of the alcohol that the pleasant sensations at first produced by it are not so easily called forth, and he begins to look upon these wines, weak in alcohol, as very poor and insipid; and in order to arouse the feelings he desires, he soon prefers the ports and sherries.

Indeed, so general has wine-drinking become, that the taste of the greater number of people is already so spoiled that scarcely any of the wines are strong enough in alcohol to

satisfy the class of drinkers who take to them; and, consequently, the manufacturers add extra alcohol to them. This addition answers two purposes: first, it renders them capable of being kept a much longer time; and secondly, it brings them into a condition much more gratifying to the palate of the consumer. When thus treated, they are said to be doctored, brandied, or fortified.

147. Wines are said to improve by keeping. If they be kept for some years, besides the alcohol, the sugar, and other solid matter, we shall find also, in very minute quantities, several volatile substances, which give to the wine its aroma, or bouquet. This aroma is probably more fascinating than the alcohol itself, and wonderfully enhances the pleasure people feel in wine-drinking. The deliciousness of this odour or bouquet depends very much upon the kind of grape from which the wine has been made, and the number of years it has been kept; and from these two sources

arises the reason for the great difference there is in the price of many wines. The older the wine, and the more delightful the aroma, the higher the price.

Never, therefore, make the error to suppose that the price of wine is ever any guide as to its value as a food, or even as a medicine. A bottle of wine at eighteenpence in all probability contains as much nourishment as that which costs five or six shillings; but both of them would be very dear at sixpence each.

148. Before leaving the subject of wines, I wish specially to call your attention to an opinion which is very common, and more particularly so amongst country people, but at the same time as false as it can be. The opinion is this, viz., that British wines, and home-made wines, such as gooseberry, cowslip, elderberry, etc., are unintoxicating, and may, therefore, be considered teetotal drinks. *They may not.* They all contain alcohol. They may have been made by your aunt, or your grand-

mother, who, as she presses you to drink a glass, assures you that they contain nothing that can possibly harm you, as nothing but the best sugar was added to the fruit juice.

Yes, this latter part may be true; but you must never forget that 'Wine is a mocker;' it mocks ever the care of your kind aunt or your good old grandmother; and though they added nothing harmful, the evil spirit — alcohol—has found its way there.

It was produced by the decomposition either of the natural sugar of the fruit, or of some of the sugar which is added to them to sweeten them and make them keep longer.

If you should desire to become a thorough teetotaler, your wisest plan will be to avoid everything that goes by the name of wine, and also the things used as substitutes for them (as many of these contain small traces of alcohol), and get into the habit of being content with 'honest water.'

CHAPTER XV.

Spirits, or Distilled Spirits.

149. We have now arrived at the third or last kind of intoxicating beverages.

Distillation is the name given to a chemical process for applying heat to fluid substances in a covered vessel, in order to separate one part of a mixture from the other in vapour, and for condensing the vapour again into the liquid state by cold. The process was known in remote times by the Greeks, Romans, and Arabs. The Arabs, however, were the chief experimenters. Having put the fluid he intended to experiment upon into a retort, and attached to it a receiver, he applied heat, and very soon saw that the fluid rose in the form of vapour, which gradually condensed along

the cool neck of the retort, and then fell in little drops into the receiver. Upon examination he found that the condensed liquid which collected in the receiver was very different from that left behind in the retort.

Many things were experimented upon, and it was always found that that portion which distilled over first was lighter than what remained behind. For this reason it was called a spirit (spirits being supposed to be light and airy).

150. When wine was submitted to this process the light fluid which came over first was called spirit of wine. The fluid that remained behind was found to be nothing more than water. For a long time the spirit of wine was thought to be a simple body, but in time it was found that it, too, contained a considerable amount of water. By repeated distillations and other means the whole of the water can be got rid of, and to the pure spirit the name of alcohol has been given.

151. The word alcohol means a very fine

essence, or something highly refined; and in time was applied to all very highly refined substances distilled by heat.

The simple word, alcohol, has now lost much of its meaning, and is only given to the pure spirit which is produced by the fermentation of the grape or other sugary substances that will yield this particular kind of spirit.

152. All the intoxicating spirits are produced by distillation, and in this country are manufactured from different kinds of corn, such as wheat, barley, rye, oats, buckwheat, and maize. Sugar and molasses are occasionally used.

153. The manufacture of ardent or distilled spirits consists of three operations.

First, MASHING.—The grain is ground to coarse powder, mixed with some malt, and put into the mash-tub; a quantity of warm water is then added, with which it is thoroughly mixed by the aid of machinery for two or three hours; it is then allowed to settle, and

the greater part of the clear liquor, which is now called wort, is drawn off; the remainder is again mixed up with the ground grain until quite a pasty mass is obtained; more warm water is now added, and the mixing, settling, and the drawing off of more wort repeated. The same process is gone through a third time, in order to extract all the sugary matter. It takes more than twenty gallons of water to thoroughly exhaust one bushel of grain.

154. Second, FERMENTATION.—The mixed worts are brought into a fermenting vessel, and a quantity of yeast is added to it, sufficient to decompose all the sugar. The first appearance of fermentation shows itself, about an hour after the yeast has been added, by a ring of froth around the sides of the vessel. The warmth or temperature soon rises. In four or five hours carbonic acid gas begins to escape, and the whole surface of the liquid is covered with frothy bubbles. In about thirty-six hours it begins to disappear; for, as the

alcohol is formed, the fluid becomes lighter, and the heavier froth sinks to the bottom.

The mixture is stirred up from time to time. In from forty-eight to sixty hours the liquid becomes comparatively clear. The liquid itself is now called 'Wash.' One hundred gallons of this wash contain about twelve gallons of proof spirit. They are never able to entirely decompose all the sugar, or the amount of spirit would be somewhat greater.

Proof spirit is a weak alcohol, containing almost equal parts by weight of pure alcohol and water.

155. Third, DISTILLATION.—Most distilleries are supplied with two stills: a larger and a smaller one. The first is called the *wash-still*, and into it the wash we have just been speaking about is conveyed, and from it is distilled a weak spirit which is called *low-wines*. The second *still* is called the low-wine still; and it serves to rectify the product of the first distillation, the low-wine.

At the beginning and also towards the end of this operation, a very unpleasant-smelling oil is distilled over with the spirit. This oil is carefully separated from the clear, limpid liquid by suitable means.

CHAPTER XVI.

Distilled Spirits—*continued.*

156. The distilling apparatus in one of the large London establishments is thus arranged :

The wash is conveyed by pipes from the fermenting vessel to a large closed iron cistern, capable of holding 30,000 gallons. It is heated by a fire underneath, and is terminated at the top by a cover or lid, which gradually narrows and extends itself in the shape of a tube until it joins the worm, which is a long coil of copper or tin piping surrounded by a vessel of cold water. The wash is made to boil; and as the alcohol boils at a much lower degree of heat than water does, it passes off in vapour before the latter boils: some steam, however, goes with it, and thus weakens it.

The worm-tub is about thirty feet high, and is filled with a constantly flowing stream of cold water, which keeps the copper worm so cool that the vapour from the still is condensed into a liquid.

This liquid, forming the low-wines, flows out of the narrow end of the worm into the low-wines receiver, from which it again flows into the spirit-still. Another distillation occurs, and sometimes even a third, until it contains so little water as to leave the spirit the strength required.

From this spirit can be made, and indeed are made, nearly all the intoxicating spirits of commerce: by which I mean brandy, whisky, gin, and rum.

157. The spirit is now sent to quite a different establishment, viz., the rectifier, whose business it is to modify its strength, to colour and flavour it according to the taste of the wholesale customers.

158. Scotch and Irish whisky undergo no

artificial flavouring: their peculiar smell and flavour being due to the presence of the unpleasant oil I referred to, to which the name of *fusel oil* has been given.

159. Whisky contains from forty-five to forty-six parts of alcohol and fifty-four or fifty-five parts of water in every one hundred parts. It contains no solid matter.

160. English gin is flavoured with juniper berries, and sweetened with sugar. It contains much less alcohol than other spirits: the strongest gin being composed of thirty-eight or thirty-nine parts alcohol and sixty-two or sixty-one parts water in the hundred.

161. Rum is another of the spirits in common use. Properly, rum should be manufactured from common brown sugar, or from molasses; but doubtless the greater part is made from the ordinary grain spirit, coloured with burnt sugar and flavoured. It is a matter of no consequence, for which ever way it is made, it comes to the same thing in the

end. It contains about forty-eight per cent. of alcohol, and fifty-two per cent. of water, coloured and flavoured artificially.

163. Brandy.—This is a word of German origin, and signifies burnt wine, or wine that has been acted upon by fire. It is in reality the spirit *of wine;* being separated from wine by means of heat, by the process of distillation. Brandy is obtained not only by distilling the wine itself, but also by fermenting and distilling the skins and other remains of the grapes, after the juice has been expressed.

Brandy began to be distilled in France about the year 1340 A.D.; but it was prepared only as a medicine. It was supposed to possess wonderful curative properties, and was foolishly called by the physicians Eau de Vie—water of life; a name by which it is still known, but to which it has not the slightest right, for it is one of the greatest destroyers of human life that we have in our midst.

The brandies that are most highly prized

seem to owe their peculiarity to being made from white wine, and so carefully distilled as to be quite free from the acrid oil of the skin of the grape. When brandy is fresh distilled it is quite colourless. By keeping, however, it acquires a slight tinge, especially if it be kept in wooden casks.

The colour is also deepened to any required extent by the addition of burnt sugar. A second-class brandy is made from the red wines of Portugal and Spain. By far the greater part, however, is imported from France. In 1876 nearly eight million gallons were imported. For every gallon imported the Government of this country is paid 10*s.* 5*d.*; so that the revenue from this source amounted to about four million pounds.

Brandy is the strongest, and therefore the most dangerous, of all the ardent spirits. None that would be termed good brandy contains less than fifty per cent. of alcohol, and some will contain as much as fifty-four per cent.,

and only forty-six parts of water in the hundred.

Wine, then, is the correct source from which brandy is manufactured; but besides this there is also a great deal of British brandy: this is manufactured from grain, coloured with burnt sugar, and flavoured.

163. The amount of solid matter contained in any of these spirits is so small, that if you were to evaporate a pint of either of them, you would find nothing left but a dirty stain upon the basin; they therefore contain no food materials: indeed, as a food, spirits are utterly useless; and there are very few people now who look upon them as being nourishing, but they speak of them as being stimulating or strengthening, very wrongly confounding the meaning of the two words. They stimulate only as a whip does, by taking strength out of you, and not by imparting strength to you as food does.

Upon carefully examining these spirits we

shall find that they all resemble each other very closely, and that they are all simply mixtures of alcohol and water, differently coloured and flavoured; being thus composed, as the flavouring agent forms scarcely an appreciable proportion of the mixture:

	Brandy.	Rum.	Whisky.	Gin.
Alcohol .	54	48	46	38
Water .	46	52	54	62
	100	100	100	100

164. The alcohol is so strong and irritating, and the flavourings are so disagreeable to the natural taste, that the spirits are quite unpleasant, worse than medicine, to children and people who have never taken them; yet, strange to say, if people go on taking them they get to like them very much indeed; often to such an extent that they would part with anything rather than give up their habit, which by degrees sticks to them so tightly that many of them become drunkards, and die as such.

CHAPTER XVII.

Economical and Commercial View of the Subject.

165. In an earlier chapter I made a remark to the effect that if I could prove to you that the manufacture of intoxicating beverages was an evil, that the very greatness of the trade made the reason all the stronger why we should try to get rid of it.

166. We are told in ancient story that Ulysses, desiring to make himself appear a madman, ploughed the sea-shore, and scattered over it salt instead of corn. Every day the advancing tide washed up his furrows, and laughed at his foolish work. I think he adopted an excellent method to induce the people to believe him mad.

167. The manufacture of intoxicating drinks

is an employment not much more sensible than that of Ulysses. Perhaps some of you think this a very strong statement for me to make, and that if I am to retain a place in your good opinion I must prove such a bold assertion. Good. Every man who wants to grow richer can only do so by one of two methods. He must either work himself, or get others to work for him. I will press the idea further, and state it more simply, by saying that *work* is the only means by which wealth can be increased. A few illustrations will probably make my meaning plain to you.

168. Suppose I have a thousand pounds, and want to increase that sum; it will be useless for me to sit down in my easy-chair, wrap my money up in a bag and bury it in the earth.

No; I must either buy articles with it and sell them for more than I gave for them, or else I must lend my money to other people to trade with, who pay it me back again with an extra

amount, which we term interest, for the accommodation it has been to them. In either case my thousand pounds would have increased.

169. Suppose a bootmaker buys a quantity of leather for six shillings; in the course of eight or ten hours, by the labour he bestows upon it, he turns the leather into a pair of boots which he values at thirteen shillings. Now you see at once that at night he is a richer man than he was in the morning, because the boots which his labour produced are of more value than the leather out of which they were made.

170. Again, suppose I am a carpenter, and I buy some boards for a few shillings; I saw them up, plane them, nail and screw and join them together in various ways, and turn them into a table; now the table becomes a much more useful article than the boards were, and because I have bestowed much labour on it, it is also worth more money, and I may be said to possess more property.

If I had bought the boards and laid them on one side in my workshop and done nothing to them, I might just as well have kept the money in my pocket.

171. A builder buys bricks and mortar, timber and glass, etc.; he pays away money to workmen, who put these things together in such a way that a substantial house is erected. Now the builder has parted with much of his money, is he a poorer man? No, he has the house in exchange; and if he wishes to sell it, it is worth more money than it cost him to build it, and so his wealth increases.

The same principle applies to every kind of *useful* labour.

172. Not only is the builder's wealth increased, but also the wealth of the country at large, and this is a very important consideration. You see that the money the builder had at first, though *he* has parted from it, still remains somewhere divided among the workmen and others; the house that is erected

being something in addition, constructed out of clay and stone and trees, which, as such, were not very valuable. The house may be considered as equal to the money he had at first, with interest added to it.

173. There is, however, another class of work which does not increase the wealth.

174. Thus, suppose, instead of employing men to build me a house, I employ them to dig holes in a field, to wheel the earth away to a distance; and when they have made very great holes, I command them to fill them up by wheeling the earth back again. Every week I pay them their wages; after a time I find my money is all gone, and I have nothing left in its place; the useless holes that were dug are all filled up; everything seems just as it was at first, except that, my money being all gone, I am a bankrupt or a poor man. How is this? My men have been hard at work all the time; ought not their labour to have increased my wealth?

175. Or again, being a wealthy man I buy a large estate, well wooded with valuable timber trees; and I say, as I am a rich man it is right for me to let my money circulate freely, and so I will employ a large number of servants. I put them to cut down my trees, saw them up, and then burn them. In the course of years my forest land is all cleared; my money has been distributed among the men as wages: but instead of selling my timber and getting more money or other property for it, having had it burnt, I find my estate is not nearly so valuable as when I bought it, and that each year I am becoming a poorer man.

176. In these cases the unpleasant result has been brought about because the servants have been employed in unproductive work. Hence we arrive at the conclusion, that, if increase of wealth be due to labour, it can only be that kind of labour which produces something, and leaves it behind after the work is

performed, which is of more value than the things operated upon. Thus a ship is of more value than the timber and iron out of which it is made; bricks of more value than clay; a coat than the cloth the tailor used in making it; a knife than the unpolished steel, and so on.

177. How does all this apply to intoxicating drink? Why, in this way:

You are aware that nearly all the intoxicating beverages are manufactured from grain or sugar. A very great deal of time and money and labour is bestowed upon the various processes adopted for their production; but unfortunately it is not the sort of labour by which the value of the corn or sugar is increased, but just the very opposite, for every change that is effected in the grain leaves the product *less* valuable: the malt is less valuable than the barley, and the beer is of less value than the malt. The whole process is one of spoiling or destruction.

178. We cannot, however, expect men to work for nothing, so the farmer, the maltster, the brewer, and the publican, all have to be paid for their work; the consequence is, that, though the article they produce is not so valuable as the thing they made it out of, a higher *price* has to be paid for it. It becomes dearer in price, but less in value. Nearly all the labour bestowed upon it has been wasted. Good grain has been turned into a useless—nay, more, into a harmful drink; and the country at large has been made poorer, by having the good grain, which its soil produced, destroyed.

Now, if this be the true principle, or right way of looking at the matter, you can at once see that the more grain there is destroyed, the poorer the nation becomes; and therefore that the larger the breweries, and the greater the trade in intoxicating drinks, the worse it is for the nation.

179. You still feel disposed to dispute my

theory, and say you are sure it must do a very great deal of good: see what a very large number of men it employs, some in making barrels, others in building breweries, etc.! See what a large amount of money is invested in it! and as the money circulates so freely from one person to another, does it not make trade very brisk and healthy? I grant you that the amount of money invested in the trade is simply enormous, and that the number of men employed by it is larger than in any *one* branch of industry in the kingdom, and that from such a union of labour and wealth a great benefit and blessing ought to arise to all classes of the community.

The question is, Does it? The answer to such question is undoubtedly *No*, it does not.

180. There are a great many people who think that if money is freely spent, it does not matter how it is circulated.

181. Suppose a dozen boys have twelve shillings between them: they play at a game,

and by-and-by one lad wins four and another eight of them; should you say that it was good for the other boys, and that the whole twelve of them were made richer thereby. Two boys have become enriched at the expense of the others; but the twelve shillings have not been increased to twenty shillings. Taking the twelve together, they remain in just the same position as at first. Wealth cannot be increased by simply changing it from one pocket to another.

182. Last year about £140,000,000 were spent in intoxicating drinks.

Where is what was purchased with such an immense sum? Drunk—entirely gone; it performed no good purpose, and there is nothing whatever left to show for it.

The brewer and the publican have been enriched by it; but the public at large, who spent the money, are so much the poorer. It is never a wise nor a right thing that a large number of people should be injured for the

benefit of a few. I say the nation is made poorer. I will explain it by an illustration:

183. There is another use to which corn is put. You are aware that it is ground up into flour by the miller, and then by the baker converted into bread. Now suppose all the bakers in England were to say that instead of selling their bread every day, they would employ their men and horses to carry it away and throw it into the sea, or some other place where it would be lost: at the end of the year what would be the result? The farmer would have received money from the miller, the miller from the baker, and the workmen their wages from the baker. So that in various channels the money would still be circulating amongst the people. But what of the bakers themselves, and also of the people who should have been fed with the bread? Most of the bakers would be ruined, and many of the people would die from starvation, unless the bread could have been substituted by something else. Seeing, however,

that the bakers *would not* sell the bread to the people, of course they, the people, still have their money, and would be able to spend it at the grocer's or butcher's, and buy rice, meat, and other things to make up for the loss of bread.

184. In your hearts, no doubt, you think the supposition I have put forward is simply an insane imagination of my brain, so utterly foolish that it is not worth thinking about, and that such an act on the part of the bakers would be so wasteful and wicked that they would not be allowed to do it.

Be that as it may, the manufacture of intoxicating drinks is quite as wasteful, and far more wicked.

185. It is wasteful, because it destroys good corn, and gives you nothing substantial for it. This, I think, you will see by the following illustration:

Say that your father and myself are engaged in the same occupation, and that we each earn two guineas a-week. I am a teetotaler, your

father a moderate drinker. He thinks it quite right to allow himself sixpence each day for beer, which in the course of the year amounts to £9 2*s.* 6*d.* In spending his money in this way, he thinks that he is encouraging trade, and that he is neither extravagant nor wasteful.

186. To try and convince him, I agree to do the same; but instead of drinking my ale each time I buy it, I pour it down the sink-drain. At the end of the year, what is the difference between us. We have both spent £9 2*s.* 6*d.* on ale. Did the ale make your father any stronger than me? Did he do more work than I did? Did it make him any happier? Did it make him spend his spare time any more pleasantly or usefully than I did mine? In what way is he better than I am at the end of the year? In no way; and if we were to examine the matter carefully, probably we should find that there was a great deal of advantage on my side. But this we will leave, and say we are equal. Well, then, as I

poured my ale down the drain, it is quite certain it was no use to me, and that I might have kept my money in my pocket. If I had done so, I should have been £9 2*s.* 6*d.* richer than your father. Or I might, by spending 3*s.* 6*d.* per week more than your father, have lived in a better house than he did. Or it might have been spent in many different ways by which many more people would have been benefited than were by buying ale. For instance, if I give the 3*s.* 6*d.* per week to my wife to buy boots and clothes for the children and other useful things for the house, I have pleasure in seeing the former better clothed; and when I return home tired from my work, I am made more comfortable by having my house, in the course of a few years, much more nicely furnished than your father has his.

The furniture would remain with me, and thus from year to year my wealth would increase; and by-and-by, when I am an old

man, I should be possessed of enough to live on without working, or having to be supported by other people.

187. Moreover, if I spend my money in this useful way I should have another feeling, and a very pleasant one, arising from the fact that if I spent nine pounds a year in useful things, I know that about five pounds finds its way into the pockets of the workmen who made the goods; whilst if I spent it on beer or spirits, only fifteen shillings would return to the worker as wages. And so I feel that I have made trade about six times brisker by my conduct than I should have done if I had followed the example of your father.

188. If everyone were to give up drinking intoxicating drinks, and spend their money in a sensible way, there would be such an increase of trade and business that there would always be plenty of work for everyone to do. No one need be out of work, and, instead of having a great army of soldiers doing nothing, we

should want all their strong arms to build houses, make furniture, clothing, etc.; and in a few years our country would become so prosperous that we should hardly know it.

189. I said that the use of intoxicating drinks was not only wasteful, but wicked.

When I poured my ale down the drain it did harm to nobody. In that case it was simply a wasteful act. Thousands of people drink so much that they seriously injure their bodies. They get drunk; they are then locked up, fined a sum of money, which ought to be spent for the use of the family; or if they have not got the money they are sent to prison. When they are there they cannot work for their family, so that the man in prison and his family outside have to be supported by rates which are collected from the hard-working and sober part of the people.

This is very unjust to those who are industrious and careful. In this way many people are made to suffer.

190. Perhaps you are anxious to know what would become of the brewers, publicans, and others engaged in the trade and manufacture of intoxicating drinks if such were put an end to, and you do not think it right that they should be thrown out of employment.

In a distillery in Edinburgh where 150 men are employed, they manufacture whisky, which is sold for nearly £1,500,000. If so much money were employed in the cotton or woollen trade, it would give employment to between 6,000 and 8,000 work-people.

That is, it would give work to at least forty times the number of work-people than it does at present. A careful examination has shown that if all the money spent upon drink was spent amongst the useful trades, it would find employment for seven or eight times the number of people it does at present. The publicans and brewers would simply have to change their occupation, and there would be an immense amount of work waiting for them to do.

CHAPTER XVIII.

Moral View.

191. BEFORE closing the book, I wish to say a few words, as one who not only takes an interest in seeing boys and girls happy and well informed, but also as one who desires to see them grounded in right principles and striving to be *good.*

I wish, as briefly as possible, to place before you some of the results which flow from the use of intoxicating drinks, believing that they will teach their own lesson.

192. As nearly as can be estimated, the population of the United Kingdom at present is 34,000,000; but of this number 8,500,000 are under the age of 15 years; there are also 500,000 people who never buy intoxicating drinks, so that we may reduce the number of those who do so to 25,000,000. The amount of money spent last year, in round numbers,

was £150,000,000; that is equal to £6 for each individual, or £21 for every family. This is a very large amount of money, and much more than hundreds of families can afford to spend on any single kind of indulgence. However, the extravagance, though enormous, is but a very small part of the evil.

193. I learn from statistics I have just been examining, that last year there were the following apprehensions:

200,184	drunk and disorderly.
94,565	assault cases before magistrates.
41,645	cases of larcency.
23,545	indictable offences.
13,521	offences against game laws.
832	wounding and stabbing.
138	murders.
8	attempts to murder.
374,511	

194. In addition to which, coroners' inquests revealed the following, viz:

1,636 suicides.

3,100 found dead.

457 excessive drinking.

1273 deaths from want, cold and exposure.

195. I find also, that in 1877 the number of paupers were :

In Ireland . . .	78,528
Scotland . . .	100,105
England . . .	728,350
	906,983

and that the cost of their maintenance etc., was £14,585,594

196. The testimonies of governors of prisons, judges and magistrates, clergymen and others ; and the confessions of criminals and murderers all unite together in proving that a very large part of this crime, pauperism, and consequent misery arises from the use of intoxicating drinks.

197. Further, it is proved by Dr. Norman Kerr, and others, that every year upwards

of 100,000 persons are brought to a premature death by the use of alcoholic beverages; while more than 50,000 annually find a drunkard's grave. These are very awful facts, but I should be glad if you would think about them for a little time; and whilst doing so, remember *that each one of these drunkards was once an innocent boy or girl.* It is intensely sad to know that before one generation of drunkards dies out, an equal number of boys and girls have grown into such. *What will you become?*

198. The Temperance Reformation was started about fifty years ago. The founders were not great, but they were good and noble men, and as such could not look round upon all the wretchedness and sin which stared them in the face from every side, without having a strong desire to do something to lessen it.

199. They thought of the Saviour's words—judged the tree by its fruits; and as far as they themselves were concerned, went to the root of the matter: they determined to abstain

from all drinks containing alcohol, and to do their utmost to persuade others to do the same. Between those early days and the present, the temperance pledge has been signed by people from a great variety of reasons: some have become abstainers in order to save money; others because they believed their health would be benefited; and some because they feared they might become drunkards.

200. All these reasons are good, but none more noble and worthy of commendation than those held by the early pioneers. *They* did not possess the knowledge you and I do, but they feared God and strove to honour Him; they loved their fellow-men, and worked to help and bless them. And even now it may be said that all who renounce intoxicating drinks for the same reasons, approach nearest to the model of the Saviour Himself, whose whole life was one continual living for the good of others.

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